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Contents

Cover: Armed Navy Seabees march to work on "Island X".
Official U. S. Navy Photograph

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Unloading barges after sundown. *Official U. S. Navy Photograph*

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Destination -- "Island X"

By HAROLD H. SCHOEN, C.E., '27

Lt., C.E.C., U.S.N.R.

Lt. Schoen

ISLAND X represents to every Seabee his active destination in the prosecution of this global war. It may be actually a small island, or it may be Africa, or Great Britain, or Sicily, or Southern Italy, or South America, or Newfoundland, Iceland, or Alaska. Unfortunately, a Seabee does not have any choice in his location. He is sent first to the training center at Camp Peary near Williamsburg, Virginia. From all accounts, the early days at Camp Peary, with its cold wind, snow, mud, and kindred "attractions", gave its first occupants a foretaste of life in the Aleutians.

It is not too well known a fact that there are several types of Construction Battalions. The most publicized one is that composed of four construction companies and a headquarters company; together with the officer personnel it totals roughly 1100 men. Then there is the Special Battalion which is trained for the important task of expeditiously unloading cargo ships at foreign ports. This is obviously a most important function in view of the necessity of keeping cargo ships moving to deliver much needed supplies and equipment to our far-flung battlefronts. Again, preventing a concentration of shipping, delayed in unloading, in many foreign ports relieves the possibility of successful enemy bombing attacks. Then there is also the smaller unit, the Supernumerary or Base Maintenance Unit. This consists of approximately two hundred men, and their function is maintenance and operation at an already completed base where not much in the way of new construction is contemplated.

THE AUTHOR

Harold H. Schoen entered Cornell in the College of Architecture but after one year transferred to the School of Civil Engineering from which he graduated in 1927. For six years he was engaged in heavy construction, foundation, and excavation work.

In 1942 he enlisted in the Navy and was commissioned in the Civil Engineering Corps. Put in charge of a contingent composed of two companies of Seabees and a Headquarters Detachment, he was assigned to an advanced Pacific base for the first five months in 1943.

Upon completing its preliminary training in Virginia, a battalion is sent to one of the various advanced training centers that are located from Passamaquoddy Bay, Maine, around the coast to Pleasanton, California. At these stations men receive advanced training in construction methods, as modified by practical combat demands, and in military tactics, including commando training for men under 35 years of age. Here the men receive extensive rifle range practice and are made familiar with antiaircraft gunnery. The Seabees have an additional duty to construction work out beyond, for they serve as auxiliary infantry units.

The Battalion

Our Battalion was organized early in June of 1942 and consisted of 1000 men and 23 officers. Among the latter were two doctors, a supply officer and assistant, and a dentist. The others were all civil engineers or other practical construction men with the exception of a lone mechanical engineer. After three weeks of indoctrination and preliminary training we were sent to nearby Camp Bradford for more advanced training in the type of problems likely to be encountered at our "Island X". About mid-July we got orders to leave for the West Coast — then the "Scuttlebutt" started to flow—theories were ad-

vanced as to why we were going to Alaska, to Hawaii, to South America, or to the Central Pacific.

A week aboard troop trains and we finally landed at our Advance Base Depot, where the beautiful sunny climate of California was appreciated by the northerners among us—particularly following on the damp, humid weather of Norfolk and its environs. The fact that we needed two heavy woolen blankets at night was the most attractive part of the climate. At this base we drew our infantry gear and equipment and shortly thereafter left from a West Coast port. We were instructed to bring heavy clothing in our hand gear, so the "Scuttlebutters" who had claimed Alaska as our "Island X" started crowing. As later events proved, they had crowed much too soon. Before boarding, instruction were given that all cameras should be sent home and that all radios and electric razors should be stowed in gear that was to go below. We boarded a good sized transport and within twenty-four hours were outward bound — destination unknown — though all sorts of theories and bets were being offered. After a week most pleasantly spent in eating, reading, sleeping—rudely interrupted by general quarters an hour before sunup each day, manning lookout watches and gun crews, we saw our first land—Molokai. Shortly after there appeared Diamond Head followed by Aloha Tower and finally our entry into the roadstead at Pearl Harbor. Our first sight of the hangers at Hickam Field and the sunken battlewagons gave us an idea of the havoc the "Japs" had wrought on that memorable 7th day of December in 1941.

Official U. S. Navy Photograph

The Seabees put the finishing touches on a timber bridge

Our stay on the island of sugar and pineapples lasted about six weeks. Our first duties consisted of small building alterations on projects that had been previously completed by civilian contractors, and in policing the areas. We were, however, quickly called upon to furnish unloading details at various ammunition depots and to engage in laying barbed wire on various points of the coast. Large groups were sent to a nearby Naval Rifle Range to have three days of intensive practice with the 1903 Springfield. We were all anxious to "get going." Suddenly half of the Battalion was advised to get ready to shove off. We boarded ship in full gear; our equipment, consisting mainly of small tools, cots and some trucks, was loaded aboard the various ships of the convoy and at last we were "Island X" bound.

Our ship was under command of a Naval Aviation Captain who had all of the officers in his cabin for a bull session. Our men and the ship's company men got along wonderfully, and there was immediately noticeable a tremendous improvement in the morale of our men now that we were actually underway. Each evening after chow the musicians among our men assembled on the fore deck under the direction of our doctor—the morale officer—and the band "went to town". We also had some first class entertainment—one old timer who'd served in the last war engaged in the acrobatics of a 'buck and wing' that would have done credit to a man half his age. There were also the usual dialect story-tellers and raconteurs. Just before we landed, the Skipper of the ship sent cigarettes with his compliments to all of the Seabees aboard. It was with deep feeling of admiration and respect that we parted company with the officers and crew of our transport.

"Island X"

The arrival at "Island X" was fraught with interest. The pier facilities were not sufficient for us to berth at the time, so the cargo ships drew up to the pier and we proceeded to unload men and gear via Jacob's-ladders and cargo nets aboard big barges out in the channel. On landing we were immediately broken into two groups and dispatched to two different locations. Just before dusk the group to which I was attached landed at its "Island X"—our home for the next year.

"Island X" was a small coral island about half a square mile in area with an elevation of about ten feet above sea level and a most important base in the Naval set-up. Our companions were Marines and a small Army unit. There was much work to be done and available accommodations—such as they were—had to be utilized until the future would permit us time to build barracks for our men and for the other inhabitants of the Island. Our men were quartered mainly in dugouts, although Quonsett Huts were available for some few. Due to the low elevation of the island and the torrential rains we were shortly to experience, the larger portion of each dugout was above ground. However, to furnish suitable protection against shell fire and aerial attack they were built of heavy timbers and walled with 3-inch planking and completely lined with tar paper and pitch and then covered with overhead depth of coral, which additionally served

as camouflage.

After a day or two for squaring away and making ourselves "comfortable", we started work. The first step was to erect the "Seabee Warehouse." It was a large tarpaulin covered structure which housed the field offices and held all our small tools and equipment. Its protection from the elements was a matter of very reasonable doubt. Next came the lumber area near to the sea wall where we set up a small saw-mill and made our own rough, small-sized lumber out of available 6-inch to 12-inch stock in excess of requirements for columns and girders and heavy beams.

One of our most important jobs was the unloading of supplies and equipment from the daily barge. A regular detail of riggers was organized and they erected an old stiff-leg derrick together with hoisting and swinging engines. Since these pieces of equipment had been through an earlier "blitz" there was considerable work and ingenuity involved. We were fortunate in having aboard a C.P.O. who was a crackerjack structural steel worker and high-topper—he worked wonders with what was available. Incidentally he, like many other C.P.O.'s in our outfit, has been subsequently promoted to the rank of Warrant Officer.

Improvisation

The Seabee motto of "Can Do" was exemplified many many times. There was constant improvision and substitution required due to the unavailability of many items. Although there was a well stocked G.S.K. available to us, if an item was out of stock it was not a question of calling the corner supply store. Specially required items often took a minimum of three or four months to arrive from Stateside. When all available substitutes for a certain type of material were exhausted, it meant stopping work until such time as a new supply might arrive and going on to the next most important project.

This does not intend to imply that the entire complement of officers and crew worked on only one project at a time. For in addition to new construction, there were men assigned to specific permanent duties, such as power house operation, transmission line maintenance, boiler operations, evaporative condenser operation, and the like. There were also skilled heavy equipment operators on graders, rollers, tractors, bull-dozers; also, electricians, plumbers, steamfitters and tinsmiths as well as carpenters, machinists and riggers.

The Seabee rapidly took over operation of many important facilities that had previously been administered by unskilled men. They operated the laundry, the bakery and the galley as well as the post-office, the cobbler shop and the barber shop. We had with us the only navy mail clerk on our island —also the only barber on the island, who was kept constantly occupied.

Water Supply

The matter of potable water is another item of interest. The capacity of our evaporate condensers was sufficient to give enough fresh water for drinking and limited cooking, but none for bathing, washing clothes, or swabbing decks. Consequently, every living unit had a well dug aft—this supplied brackish water that gave a reasonable facsimile of a lather for washing purposes. The laundry was done with a mixture of sea water and chemicals and results are best left undiscussed. It was, therefore, that the annual three month rainy season was looked forward to without too much alarm as it meant fresh water showers for a period. The rainwater was collected in galvanized iron tubs which were part of the assembly of a Quonsett hut. Each tub held about 250 gallons of water. When the rains came one can well imagine the showers that followed. Until one is in such a spot he doesn't realize the common place wonders of civilization's bath tubs and fresh water, among many other comforts.

The rains and cool weather down to 45°F. made the dugouts of doubtful comfort—but a small kerosene stove in each was of inestimable value for heat if not for ventilation. The rainy season was accompanied by winds of velocity up to 70 knots (a knot is 1.15 miles) and on more than one occasion we had to use cargo nets to hold down the roof of our Seabee warehouse. The large granules of coral, flung into the air and whipped across the open spaces, gave a well-done sand blasting to the exposed portions of one's anatomy. Many a time an emergency crew had to be organized to fill sand bags and protect the dock and the sea wall from being washed out. At other times fire pumping crews had to be organized to eject flood waters that broke through and flooded out under level structures. The raising of sunken barges and refloating grounded barges or boats was a matter of common occurence during such periods.

Concrete was mixed with sea water and gave suitable practical results. Prepared aggregate, a mixture of small stones, was seldom available; and the substitute was obtained by using a Northwest crane with a 60 foot boom and a

(*Continued on page* 18)

Official U. S. Navy Photograph

A Quonset hut in the process of erection in a jungle clearing

Testing Foundry Sand

By D. C .WILLIAMS

Research Fellow, Cornell University

THE AUTHOR

D. C. Williams is a native of the Midwest. He graduated from Beloit College in Wisconsin in 1930 with a B.S. in chemistry and is a member of Phi Kappa Psi fraternity.

After doing chemical work for several concerns, Mr. Williams came to Cornell to do research on the high temperature properties of sand mixes.

SAND Research! What do they do in that room?" That is the question that so many students and visitors ask as they look into the "Sand Lab" when passing by along the corridor. Open doors and walls that are not sound proofed make it easy for those inside the "Lab" to hear the remarks.

"Step in and we will try to explain." The American Foundrymen's Association in co-operation with Cornell University is conducting an investigating of the physical properties of steel foundry molding sands at elevated temperatures. The Association has created a Sand Research Committee, with Dr. H. Ries as Technical Advisor, to direct all foundry sand investigations. The Sand Research Committee is subdivided and sub-committees pursue various fields of investigations. The program at Cornell University is under the direction of Professor J. R. Moynihan and the "Sub-committee on Physical Properties of Steel Foundry Sands at Elevated Temperatures", designated as 6-B-7.

In most commercial operations involving silica sand (Si 0_2) work is begun at or near room temperature. In the foundry the sand mold is at room temperature and molten metal is poured into the mold cavity. The sudden introduction of molten metal causes many reactions which at the present time are not well understood. To approach the conditions met with in the foundry, a laboratory procedure is being investigated whereby a molded sand specimen is submitted to shock heating at elevated temperature and tested for various properties.

The properties of a molded sand specimen is said to be affected by many variables. The Sub-committee (6-B-7) has adopted a program for the investigation of the variables encountered in the foundry. The name "basic research" has been selected for a single-variable program of investigation which means the holding of all but one of the variables constant while determining the effect of *the one* chosen variable. It appears questionable if all but one variable can be held constant. Below are given the variables as determined by the sub-committee.

1. Sand grain size.
2. Moisture content of sand mixture.
3. Time of temper (storage, after mixing, in a sealed container).
4. Time of mixing.
5. Type of binder materials
   (a) Clays
   (b) Organic
   (c) Inorganic
6. Silica Flour (pulverized quartz).
7. Degree of Ramming.

The investigation of the effect of these variables has been laid out along the lines of the "external approach." By trial and error methods it is hoped that certain safe trends can be made available to the foundryman.

Mechanical and Physical Tests

The Sand Laboratory at Cornell is equipped with two types of mechanical mixers which mix the silica sand, binders and water. After mixing, any or all of the following mechanical and physical tests may be made on the molded sand specimen.

A. Room Temperature

1. Green Compression
2. Green Deformation
3. Green Permeability
4. Green Hardness (Mold Hardness)
5. Green Tensil
6. Green Shear
7. Retained Compression (after heating and cooling to room temperature).
   (a) Dry (210-220°F)
   (b) Baked (220°F to approx. 600°F)
   (c) Hot (600°F-3000°F)
8. Retained Deformation (Dry etc.)
9. Retained Permeability (Dry etc.)
10. Retained Hardness (Dry etc.)
11. Retained Tensil (Dry etc.)
12. Moisture Content

B. Elevated Temperatures

1. Compression
2. Deformation

3. Collapsibility
4. Transverse
5. Linear Expansion

The American Foundrymen's Association has adopted standard methods for many of the room temperature tests. They can be found in the book "Testing and Grading of Foundry Sands and Clays". All testing in the "Sand Lab" is conducted according to those standards. The permeability apparatus and sand specimen rammers used in the "Sand Lab" were made at Cornell University. All the remaining room temperature equipment has been purchased.

Previous Tests

Many previous studies at elevated temperatures were carried out using a gas fired furnace built at Cornell University. This furnace has been recently dismantled. Elevated temperature studies, at present, are carried on, using commercial testing equipment. After the sand mixture has been made and allowed to stand in a sealed container for 24 hours it is ready for testing. A weighed amount of sand is rammed up into a specimen which is then dried or baked, cooled over a desiccant until needed. At present there are no standard methods for elevated temperature tests. However, the manufacturer of the test equipment does recommend a complete procedure for hot compressive strength tests.

First, sand of uniform moisture content is thoroughly mixed and then screened through a No. 6 mesh screen. Since the hot strength of sand changes with aging after mixing, the sand must be stored in a sealed container without packing.

The top of the bottom post is thoroughly cleaned to remove any loose sand; the surface is made flat by holding it against a flat disk grinder. Then both posts are firmly set in their respective holders by tightening the Allen set screws.

For the 2000°F. test, the furnace is brought to a stable temperature of 2225°F. Then, when the furnace is raised and then lowered over the sand specimen, the temperature drops to the required 2000°F. during the first 15 seconds after the furnace is down. If the 2000° temperature is not attained, the preheat temperature may be varied from 2225°F.

Sufficient sand must be weighed out to give a rammed sand specimen of 2″ plus or minus 1/32″. The sand must be rammed shortly after weighing to prevent air driving. To do this, the sample must be poured into the specimen tube. The tube is placed under the rammer and the tube and post are rotated by hand about one-half revolution. Then the pin is removed, the grip is eased, and the specimen tube is allowed to come to rest easily. The sand rammer is bolted to an iron plate or a concrete pedestal. The specimen is rammed with three drops; then the specimen is stripped from the tube.

Refractory Disks

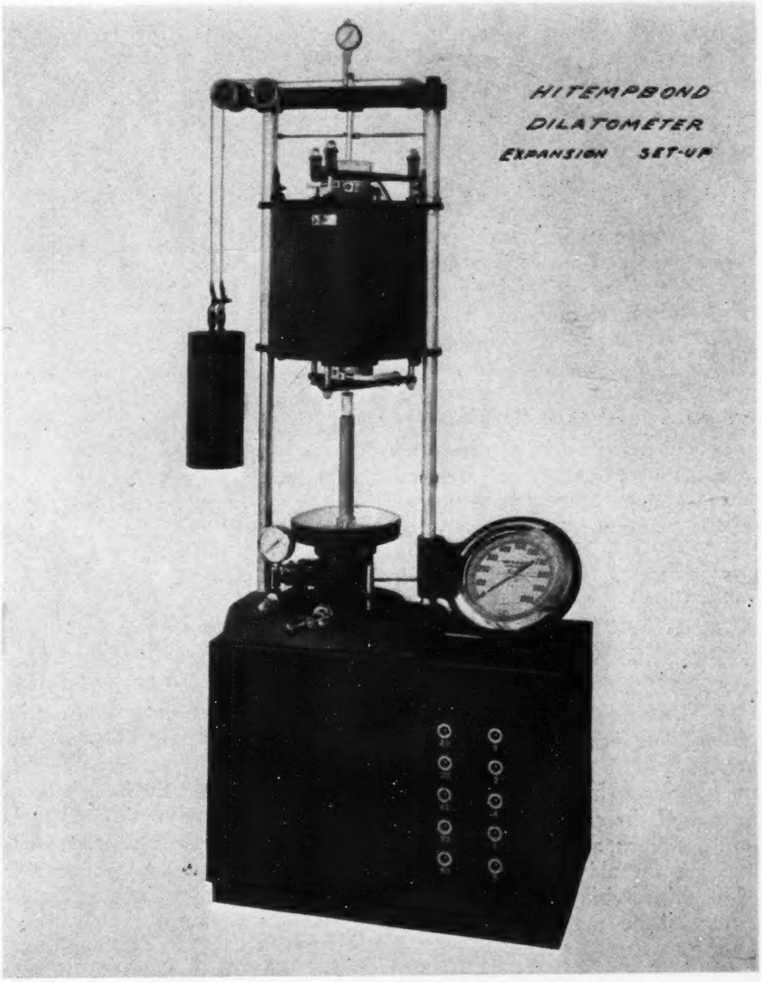
A flat refractory disk is pressed against the bottom of the rammed sand specimen with a quarter revolution rotating motion. These disks must be very flat and may be resurfaced on a flat surface grinder.

With the same care, a flat convex disk is placed on top of the specimen. Using crucible tongs, the sand specimen with refractory disks on each end is placed on the case of the dilatometer.

With the furnace at the correct preheat temperature, the furnace is raised, the specimen is quickly lifted by gripping the bottom disk, the specimen is set on the bottom post, and the furnace is lowered. Usually this entire operation can be done within 6 seconds, without varying from this by more than one second. The timer starts from zero when the furnace is lowered, and begins clocking the soaking period cycle.

The load is applied to the sand specimen at a rate to give a loading table rise of 1 inch per minute and to cause the sand to break within 10 seconds of the chosen soaking

(*Continued on page 24*)



Hitempbond Dilatometer used in sand research

Magic with Mathematics

By ROBERT N. GOLDMAN, EE, '47

We all have studied mathematics because we had to—it is a necessary part of an engineering education. But in so doing most of us have overlooked the interesting aspects of mathematics. For math, in spite of the terrors of White Hall, has many fascinating sidelights.

First of all there is pi, which, as you undoubtedly know, is equal to 3.141592653589793238462643383279 5028841971693993751058209749445 9230781640628620899862803482534 2117067982148086513282306647093 8446095505822317253594081284811 1745028410270193852110555964462 2948954930381964428810675665 93 +. The entirely useless accuracy of this value for pi is apparent when it is realized that ten decimal places would be enough to give the circumference of the earth within a fraction of an inch, and that thirty decimal places would give the boundary of the entire visible universe within a fraction too small to be measured by the most powerful modern telescope![1] Pi, many engineers seem to think, is merely the ratio of the circumference of a circle to its diameter; the number, though, has a peculiar knack of cropping up again and again in mathematics. For instance take the following series:

$$1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} + \frac{1}{13} - \frac{1}{15} +$$

Add together the numbers written above and you will have a not-too-good approximation of pi over four. But the longer the series is continued the closer will be the approximation, for pi over four is the limit of the sum of the series.[2] Similarly pi over two is the limit of the sum of the following series:

$$1 + \frac{1}{3} \times \frac{1}{2} + \frac{1}{5} \times \frac{1.3}{2.4} + \frac{1}{7} \times \frac{1.3.5}{2.4.6} + \frac{1}{9} \times \frac{1.3.5.7}{2.4.6.8}$$

And pi over two is the limit of the product of this series:

$$\frac{2.2}{1.3} \times \frac{4.4}{3.5} \times \frac{6.6}{5.7} \times \frac{8.8}{7.9}$$

But the mathematical versatility of pi doesn't end there. Try the following experiment. Rule off on a piece of paper parallel lines whose distance apart is equal to the length of a needle. Now drop the needle on the paper several hundred times, counting the number of times the needle falls across one of the ruled lines. You will find that the ratio of the number of times the needle crosses one of the lines to the total number of times the needle is dropped is approximately equal to two over pi. (The more trials that are made, the closer will be the approximation.) Unbelievable though it may seem, in this haphazard dropping of a needle on a piece of ruled paper, the mathematical probability that the needle will cross a line is exactly equal to two over pi, an expression involving the seemingly irrelevant ratio of the circumference of a circle to its diameter. This is a special case of Buffon's Needle Problem which states that where L is the length of the needle and H is the uniform distance between the ruled lines, the probability, P, that the needle will intersect one of the lines is: P = 2L over pi × H.

This expression has been proven several different ways theoretically and experiments during the past few hundred years have confirmed the theory.[3]

Much older than the first accurate approximation of pi, much older than almost all modern mathematics, with an origin steeped in mysticism, is the magic square. A magic square is an arrangement of numbers, all different, in the form of a square in which any full row, vertical or horizontal plus either diagonal, adds up to the same number. The magic square is at least 3000 years old; they have been found in Chinese manuscripts dating from 1000 BC. During the middle ages they were associated with witchcraft and superstition. It was a good luck omen—inscribed on a silver plate the magic square protected its owner from plague. "Melancolia", one of Durer's most famous engravings, includes this magic square which is used in it as a mystic symbol:

16	3	2	13
5	10	11	8
9	6	7	12
4	15	14	1

Notice that the sum of the numbers in any vertical or horizontal row, and also the sum of the numbers in either of the two long diagonals, is equal to 34. It is made up of the numbers from 1 to 16 and no number is used more than once.

The simplest and most ancient form of the magic square is the one below. It is the one found on the oldest Chinese manuscript, and is the one that was usually used as a good luck charm in medieval times.

4	9	2
3	5	7
8	1	6

There is a very simple rule for making magic squares of an odd number of rows of any size that you desire. Briefly, this is it:

1. Draw the blank square making it as large as you want, but with an odd number of rows.
2. Place the number 1 in the middle square of the top row.
3. Sketch three more squares on two sides of the first one, as shown in the example.
4. On the diagonal ascending to the right from the number 1 place the number 2, and continue along the diagonal until the number which coincides with the number of rows in the magic square is reached, 3 in this case. (see example).
5. Place these numbers in the original magic square in the positions which would correspond to the positions of the numbers in the sketched squares about it.
6. Directly below the number at which you stopped put the next number, continuing along the ascending diagonal until a multiple of the number equal to the number of rows in the magic square is reached.
7. Repeat steps (5) and (6) until the magic square is complete.

					6
			3	5	
		2	4	9	
8	1	6	8		
3	5	7			
4	9	2			

In the United States, Benjamin Franklin did a great deal of research into the properties of magic squares and invented some very "magical" magic squares. One of them is reproduced here. Here are just a few of its many properties: Every horizontal and every vertical row of eight numbers adds up to 260; either half of any one of these horizontal and vertical rows adds up to one-half of 260, or 130; any square block of four numbers adds up to 130; the numbers in the four corners add up to 130. A short investigation will disclose many other arrangements of four numbers total rangements of four numbers which total 130 and of eight numbers which total 260.[4]

52	61	4	13	20	29	36	45
14	3	62	51	46	35	30	19
53	60	5	12	21	28	37	44
11	6	59	54	43	38	27	22
55	58	7	10	23	26	39	42
9	8	57	56	41	40	25	24
50	63	2	15	18	31	34	47
16	1	64	49	48	33	32	17

The formation of magic squares had remained a mystery for centuries. They were formed by trial and error before the laws which controlled the making of them were discovered. But there still are in mathematics a great many unsolved problems; and many of them are of an intriguing nature. A few of the more famous ones will be mentioned here.

Unsolved Problems

Very rarely do you see a map which uses more than four colors. A mapmaker, who wants no two countries which have a common boundary on the map to be of the same color, never has to use more than four colors. No one has yet been able to prove that no more than four colors are necessary to color a map; but no one has yet been able to offer an instance (on a plane or spherical surface) where more than four colors are needed. Do either of these things and your name will go down in mathematical history. Before trying it though remember that mathematicians have been trying to prove the four color theorem for hundreds of years, and there always has been a flaw in their proofs.

Another unsolved problem of mathematics is known as "Fermat's Last Theorem". It was first proposed by a French juror, Fermat, who insisted that he had a proof for it. Suspiciously enough, however, he never showed anybody his proof to the day of his death. At the present time no proof is known, but neither is any reason known to doubt its truth. This is the theorem: "There is no integral value of x, y, or z, that will satisfy the equation

$$x^n + y^n = z^n$$

if n is an integer greater than 2." The sum of two cubes, for instance will never be another cube if this theorem is true.

"St. Petersburg Paradox"

The next problem is not unsolved in the sense that no mathematical proof is known for it; that's just the trouble—it can be proved mathematically but seems, nevertheless, to be the opposite of what common sense tells you is so. The solution seems to be absurd. The problem is known as the "St. Petersburg Paradox". Answers to why the paradox is true have been offered by as eminent mathematicians as Daniel Bernoulli and Bertrand Russell. Bernoulli, who had one of the greatest mathematical minds that the world has produced, was sufficiently confused by the problem to babble something about "moral expectation" and the difference between the value of money to a pauper and to a millionaire, in his answer. Here is the innocent-sounding problem:

"A penny is tossed until heads appears. If heads appears on the first throw the bank pays the player one dollar. If heads appears for the first time on the second throw the player receives two dollars. If heads appears for the first time on the third throw he receives four dollars. If it appears for the first time on the fourth throw he receives eight dollars, and so on. What should the player pay the bank for the privilege of playing the game, in order that the game be equitable?"

And here is the irritating answer: A study of the problem shows that the value of expectation is the reciprocal of 2^n of winning 2^{n-1} dollars. So the value of expectation is

(*Continued on page* 28)

ALUMNI NEWS

In The Service

STATIONED with the army engineers at the Pentagon building in Washington, D. C. is Colonel Elvin R. Heiberg of Arlington, Va. Colonel Heiberg is a CE and was graduated in 1929. Also stationed at Washington, is Lt. George S. Jackson, U.S.N.R. Lt. Jackson, ME '22, is stationed with the bureau of ships.

Among the Cornellians serving with the armed forces overseas are Lt. Col. Emil F. Klinke, CE '34, and Captain Roger E. Higgins. Capt. Higgins, C.E. '32 is serving in the field artillery. He is a native of Brooklyn.

Lt. Col. Klinke is operations and training officer, engineering section, on General MacArthur's staff. He was appointed to this important post soon after the Southwest Pacific Command was formed in April, 1942.

Two EE's, Lt. Col. Clarence R. Carr '33 and Major Frank A. Parsons '37, are stationed at the Aberdeen proving grounds at Aberdeen, Md. Lt. Col. Carr, who was raised to that rank in October, is chief of the small arms branch, arms and ammunition division there. Major Parsons is the director of the Ordnance bomb-disposal school.

Post-War Education

ELIMINATION of barriers to peace, and training young men and women to meet enlarged opportunities in business after the war are suggested by two industrial executives in the symposium on post-war education being conducted at Cornell through the Alumni News.

Current contributors of their views are William Littlewood, M.E. '20, vice president of American Airlines, and Larry E. Gubb, B.S. '16, chairman of Philco Corp.

Littlewood pointed out a prime objective of education, both national and international, must be the elimination of those barriers of custom, language, ignorance, and misinformation which in the past have bred misunderstanding, suspicion, envy, and hate. He said he believed these are the prime causes of war, no matter how well the excuses are cloaked under the headings of political, social, economic, or religious problems.

"Tremendous forces are at work . . . moving pictures, all forms of communication, all modes of transportation, and the wide dissemination of books and periodicals in foreign languages, are influences of the constructive type. Educational activities should line up squarely behind and promote them in every constructive way."

The airline executive said he favored a "post graduate planning" type of education in which specialization is deferred beyond the normal four-year period, and in which the student is alternately exposed to college and business or industry.

Gubb declared that far more extensive education than ever before will be needed, whether college graduates plan to enter government service, the Army or Navy, the professions, industry, or finance. "This will be especially true in the physical sciences whose frontiers have been vastly extended during the war."

He said the physical sciences form the basic of radio and television, chemistry, aviation, and in fact all industries holding unusual promises for growth.

Another point stressed by the radio executive was that business leaders must be prepared to integrate activities of their companies with the national economy, in order to avoid radicalism, maintain stability, and fulfill their obligations in the world of the future.

Winter Meeting

THE winter meeting of the Cornell Society of Engineers was held at the Cornell Club of New York on Friday evening January 21, 1944.

It consisted of a buffet supper, after which Captain Maurice Witherspoon, U.S.N., Chaplain of the 3rd Naval District, spoke on the subject of "Things I have learned at the Front", followed by a talk on his experiences in the Middle East War Area by Lt. Col. J. A. McAlarney, U. S. Engineers, recently returned to this country. In conclusion the U. S. Army film "War Department Report" was shown to the 130 members and guests present.

Bernard A. Savage, M.E. '26, Executive Vice President, presided and introduced the speakers.

J. R. Moynihan

IT has been announced that Professor John R. Moynihan, M.E. '26, has been elected to membership in Phi Kappa Phi, national honorary scholastic society. Moynihan is Associate Professor of Engineering Materials at Cornell.

The society voted $100 to the Cornell University Library Associates as a token of its interest in the acquisition of important and rare books for the libraries on the campus.

Production Award

ALFRED Marchev, former Ithacan and president of Republic Aviation Corp., has received official notice that maintenance of production standards entitles the firm to add a white star to its Army-Navy production award flag.

Marchev worked for several years in Ithaca, including connection with the Thomas Morse Aircraft Co. He married a Cornellian and native

(*Continued on page* 30)

NEWS OF THE COLLEGE

Chi Epsilon

At a meeting on January 20, the following men were elected to membership in Chi Epsilon, honorary society in Civil Engineering:

Prof. Howard M. Gifft
Prof. Herbert T. Jenkins
Richard Pian, Grad.
Wayne A. Faulkner, V-12
James R. Schyler, V-12
Paul L. Troast, Jr., AST-ROTC
Lathrop Milman, AST-ROTC
Charles S. Hart, V-12
Robert Pettigrew, USMCR
Ferdinand Wascoe, V-12

Chi Epsilon is assisting in hydraulic research under the direction of Professor E. W. Schoder of the C.E. school. The work is on the characteristics of submerged orifices and their use as meters in pipe lines.

Every member puts in several hours of work weekly at the lab, taking data and also making computations of data. Thus the group is helping to carry out a project that otherwise could not have been started due to the lack of available graduate students.

The initiation banquet for the new members was held Saturday, February 19, at the Alhambra Grill. After dinner an address was given by Professor Michael G. Malti of the School of Electrical Engineering.

ASME

The Cornell Student Branch of the ASME met in Room 2, West Sibley on February 8, 1944. Mr. Harding of the Rochester Gas and Electric Company spoke on "Not in the Textbook". The speaker emphasized that textbook information is, as he put it, "prepared food", all nicely chopped up, purified, and ready for consumption. The engineer must learn to prepare his own, for he will not always find information he needs so prepared.

Following the lecture, the motion picture, "Cannon with Wings", concerning the Bell Aircobra, was shown. The picture showed many interesting details of the manufacture of the fighter, with particular emphasis on the methods of simplification which make the present rate of production possible while using no more skilled workers. There were also many beautiful color views of the Aircobra in action and other interesting facts about the aircraft, and particularly its armament.

Refreshments were served after the picture and membership cards for the new year were distributed.

Revise and Return

On Saturday night, February 26, the Knights of Olin of the School of Chemical Engineering presented their first variety show, "Revise and Return". Written and directed by the school's faculty members and students, every member of the graduating class took some part in the production or presentation. W. L. Kranich of the faculty was in charge of the vocal numbers while Frank W. Dittman directed the instrumental groups. The skits, based on actual experiences from the lives of young Chemical Engineers, were written and directed by Charles A. Baker and James M. Scovic.

Professor Rhodes played himself in a satire on his famous 710 course and reports. It was from his comment, so frequently found in these reports, that the show was named. Later, Professor Mason gave a fascinating lecture on Chemical Microscopy. Unfortunately, something seemed to go wrong with the slides he used and flashes of feminine beauties kept appearing on the screen.

The proceeds of the show went to the Chemical Engineers' Loan Fund. A great success, the presentation was thoroughly enjoyed by a large audience.

Sigma Xi

A Sigma Xi public lecture was given on Tuesday, February 15, in Olin M. Professor Agnew, head of the department of mathematics, introduced the speaker, Lt. Edwin Carpenter, director of the Steward Observatory of the University of Arizona, now stationed at Cornell.

The lecture, entitled "The Universe of Galaxies", described the recent discoveries concerning the celestial universe, and the theories which have been derived from these discoveries. Beginning with a decription and slide of a model of our own galaxy, the speaker developed the theory that the entire solar universe for as great a distance as existing telescopes can penetrate consists of just such galaxies, that nebulae are but such galaxies, and that star clusters are groups of galaxies. The statistical backing of this new theory was explained. The lecturer finished with a comparison of the tremendous distances under consideration as compared with the history of man; for light takes longer to come from the stars which can be seen with the telescope than has elapsed since the first man. The study of the universe has barely begun!

Tau Beta Pi

On Wednesday evening, February 23, Tau Beta Pi, national engineering honorary society, elected officers for the Cornell chapter for the coming term. They are as follows:

President, Robert H. Garmezy, M.E.
Vice-president, Robert B. Benscoter, V-12
Recording secretary—M. James Stooker, Chem.E.
Corresponding secretary, Ransom Hammond, V-12
Treasurer, Joseph F. Davis

Citation For Gallantry

Of interest to all Cornell engineers was the recent citation for gallantry of Harry Jennings Dennis Jr., a Navy V-12 student in Engineering. The citation, coming from Vice Admiral Randall Jacobs, chief of Naval Personnel, was read by Capt. B. W. Chippendale, commanding officer of the Cornell Naval Training School, before the assembled battalion of which Den-

(Continued on page 30)

Senior Class, 1944, Sibley School of Mechanical Engineering

1. French, D. E.
2. Kraus, L. C.
3. McGahie, W.
4. Bachmann, W. A.
5. Wilkins, G. M., Jr.
6. Barnard, W. N., Director
7. Hollister, S. C., Dean
8. Lietzke, D. A.
9. Silver, A. H.
10. Eilen, H. C.
11. Sheble, H. N.
12. Jacobson, H.
13. Bartlett, A. J.
14. Funger, R. A.
15. Schoenlank, R.
16. Nachbar, W.
17. Griffiths, W.
18. Herring, F. M., Jr.
19. Anderson, J. R.
20. Wood, W. D.
21. Gerow, W. G.
22. Bodholdt, D. B.
23. Wright, B.
24. Livingston, E.
25. Willis, D. A.
26. Guy, R.
27. Doerschuk, H. C.
28. Dent, T. A.
29. Clark, J. McC.
30. Smith, T. L.
31. Dykema, R. K., Jr.
32. Basse, W. A.
33. Berkowitz, L. K.
34. Collins, P. C.
35. Miller, A. H., Jr.
36 Schlegel, W. H.
37. Finch, F. E.
38. Baxter, H. H.
39. Williams, P. J.
40. Minnock, W. F., Jr.
41. vom Eigen, P. R.
42. Search, C. H.
43. Whinery, R.
44. Yarak, J. M.
45. Bryan, R. T.
46. Carman, E. H.
47. Parrett, J. T.
48. De Marco, V. P.
49. Michaels, G. R.
50. Hanle, R. A.
51. Bragar, N. H.
52. Schwieg, F. P.
53. Dirk, R. A.
54. Leech, R. R.
55. Perelli, C. A.
56. Frasca, R. L.
57. Ruth, C. W.
58. Hirsch, E. F.
59. Woitovich, J. M.
60. Beehler, A., Jr.
61. Bishop, G. W.

Senior Class, 1944, School of Civil Engineering

1. Rich, F. D.
2. Curry, L. B.
3. Neureuter, R. W.
4. Crohurst, H. T.
5. Malcolm, W. L., Director
6. Underwood, P. H., Professor
7. O'Rourke, C. E., Professor
8. Milhan, R. G.
9. Garcia, C. A.
10. Epifano, S.
11. Bigelow, W.
12. Hughes, W. R.
13. Steele, G. H.
14. Faulkner, W. A.
15. Schuyler, J. R.
16. Benscoter, R. B.
17. Reidy, R. A.
18. Hyland, J. J.
19. Vollmer, G. J.
20. Lueder, D. R.
21. Troast, P. L.
22. Siegler, M. A.
23. Schiffman, R. L.
24. Brinnier, A. S.
25. Daley, W. B.
26. Israel, L.
27. Valentine, R. J.
28. Duncan, A. A.
29. Mendez, H. M.
30. Lennox, G. H.
31. Marshall, N. E.
32. Finch, J. W.
33. Porter, J. I.

Senior Class, 1944, School of Chemical Engineering

1. Olsen, J. L.
2. DeLaMater, G. B.
3. Sampson, E. M., Jr.
4. Burg, M.
5. Woods, W. E., II
6. Woodle, R. A.
7. Moore, R. A.
8. Walko, E. J.
9. Rhodes, F. H., Director
10. Kranich, W. L., Instructor
11. Cole, J. M.
12. Walser, F. R.
13. Edge, D., Jr.
14. Parker, H. A., Jr.
15. Taylor, W. N.
16. Hickey, K. J.
17. MacRitchie, W. J.
18. Winding, C. C., Assoc. Professor
19. Howe, H. G.
20. Jacobs, H. H.
21. Kimple, B. A.
22. Taussig, C. A., Jr.
23. Schroeder, L. A., Jr.
24. Campbell, S. J.
25. Ross, J. D., Jr.
26. Kinne, W. E., Jr.
27. Yakovleff, P.
28. Tolle, E. J., Jr.
29. Simmonds, R. H.
30. Swenson, O. J., Assoc. Professor
31. Baker, C. A., II
32. Perryman, E. F.
33. Newman, J. A.
34. Westberg, J. E.
35. Shoemaker, F. C. W.
36. Maclean, D. C.
37. Clement, G. M.

Senior Class, 1944, School of Electrical Engineering

1. Sheheen, S. J.
2. Logue, J. C.
3. Koch, R. C.
4. De Gregorio, J. F.
5. Arbuckle, F. M.
6. Thompson, M. C., Jr.
7. Prasil, A. J. G.
8. Stolaroff, M.
9. Rochlin, R. S.
10. Shaw, D. B.
11. Cushing, M. R.
12. del Palacio, J.
13. Janowitz, S. H.
14. Hessey, J. H., IV
15. Layburn, R. L.
16. Mackeown, R. C.
17. Scrafford, R. L.

PUBLICATIONS

Production Engineering by Earle Buckingham, John Wiley & Sons, Inc., 1942, 268 pp., $2.50.

"What kind of work can I get after the war?" This is a question in the minds of many young engineers, in service, in industry, and in training.

A broad answer to this question may be found in a talk by the chairman of General Motors given in Detroit recently. In conclusion, Mr. Sloan said, "The marshalling of manpower, raw materials, production facilities, know-how and all other economic resources is to the end that more and more things are made available to more and more people in all places. This is the theory of plenty, with expanding job opportunities for all."

On the basis of Mr. Sloan's remarks, an engineer who is concerned with post-war opportunities should be interested in "Production Engineering" by Earle Buckingham.

In his preface, Mr. Buckingham cites a criticism of teaching in engineering schools: "that individual subjects are presented to the student without a concerted attempt to make them a coherent whole." He takes as his task that of showing the relationship of the various subjects or activities which are needed in the operation of any manufacturing organization.

He considers that production engineering concerns itself with three phases:

(1) Preparation for production

(2) Production operation and control

(3) Supporting activities.

In discussing Preparation for Production, the author makes clear that the functional design of a machine or product should be made separate from the production design and warns against an attempt to combine the two. An interesting discussion of tolerances is given, including cases of trouble arising on the assembly floor and in service that could have been prevented by a clear understanding of tolerances and their specification. A brief discussion is given of the factors involved in the selection of the metalworking processes to be used in making a part. The objectives and principles in tool design are clearly discussed, and timely mention is made of the tremendous importance of surface finish.

Production Operation and Control is begun with a discussion of the personnel problem in which the author stresses the importance of the quality of "common sense". He quotes: "Common sense is the gift of the gods to the chosen few—I have only a technical education." The section devoted to costs and controls is perhaps adequately treated in other books, but their relationships with the other fields of production are pointed out by the author. Many cases are cited to contrast good and bad practices and examples are given in which intelligent study has translated "mysterious" troubles into "obvious" ones.

The section on Supporting Activities is a comprehensive discussion, beginning with standardization and including a survey of process development—a tool of the process engineer, and product development —a job that is never completed.

The work is closed with a summary giving an admirable picture of the field of production engineering.

After reading the work, one feels that he has a clearer understanding of the field of production and indeed of industry as a whole. It is fortunate that a fresh, authorative treatment of production engineering has appeared during war time. It provides great stimulus to understand and participate in "post-war opportunities for all."

Paul H. Black
Associate Professor of Machine Design

The Pirotechnia of Vannoccio Biringuccio, Translated from the Italian by C. S. Smith and M. T. Gnudi, American Institute of Mining and Metallurgical Engineers, 1942, 476 pp., $5.

Most of us who have to deal with the working and forming of metals are prone to regard the art of metalworking and the science of metallurgy as developments of recent decades. The truth is that these branches of knowledge, which have undergone such rapid developments in our times, had their beginnings in antiquity, and for centuries were carried forward by the craftsmen and artists in metalworking. Not until the accumulated knowledge and the experiences of the artificer were written into books for others to study was it possible to systematize into a science the metallurgical practices. The first book having some real claim to comprehensiveness is therefore an important document in the train of developments in this field. This book is very rare, and if accessible would be unreadable by the majority of engineers in this country, because it is in Italian. It is of real moment therefore that there has just issued from the press of the American Institute of Mining and Metallurgical Engineers a scholarly translation of "Pirotechnia" by Biringuccio.

The author was born in Siena in 1480. He lived in turbulent times. He was a lad of twelve when Columbus discovered the New World. During his lifetime, Cortez invaded Mexico and Pizarro conquered Peru, both to fatten the coffers of Phillip II of Spain. But these happenings were far away. In Italy the Medici and the Borgias were busy with their intrigues and wars. Contemporaries of the author were Leonardo da Vinci, Michelangelo, Titian, Cellini and Machiavelli.

In peacetime Biringuccio was engaged in minting coins and casting objects of art, and in war in producing cannon and balls that would burst violently. His knowledge of metalworking was first-hand. His writing is direct and clear and lacks the cloak of mystery so commonly shrouding the descriptions of processes set down in his day. This man, whose book did not appear until a year later, died in 1539, the year DeSoto discovered Florida.

"Pirotechnia" consists of ten "books," the first four of which are

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Destination—"Island X"

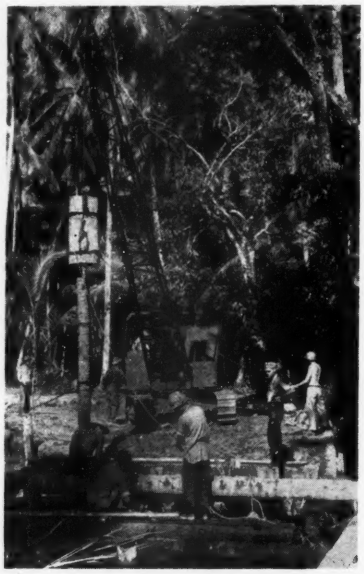
(*Continued from page* 7)

one yard bucket along the shore, thus securing a ready made mixture of sand and washed gravel or broken coral. Dead sea birds and fish were removed from the aggregate at the mixer site. Cement was available periodically so concrete and cement work was naturally staggered, dependent upon periods of supply and availability. Fortunately, between the shore and the reef there was a tremendous supply of pasty coral which was suitable for runway repairs and limited paving for auxiliary strips and the decks of revetments and work areas.

Other Projects

Several sewer lines were constructed, but we quickly discovered that vitrified tile pipe was not usable on our island as the adhesive properties of the mortar were not conducive to good results when used in thin coats. Our sewer lines, therefore, were made of either irrigation pipe or welded steel pipe.

Other projects undertaken were the building of food storage units, screened-in mess halls, underground hospitals complete with wards, operating rooms, dental laboratory,



Official U. S. Navy Photograph
Driving piles for bridge across a small jungle stream

diet kitchens, medical supply storage, and heads. (Nautically speaking, a "head" is a toilet room with showers, lavatories, water closets, urinals, slop sink and the like. You can thus be forewarned, if one of your friends writes and tells you that he has beep appointed "Captain of the Head"; you can realize he has an important job, although the honor of his command may be open to various interpretations.) Construction and maintenance and repair problems as affecting the runways, revetments, oil and gas tanks and farms, the small boat basin, gun emplacements, bomb and ammunition storage, and piers and docks cannot be discussed herein; nor can details be told regarding hangars, repair sheds, operations buildings or machine sheds.

Watertight Decks

The decks and lower bulkheads of the underground hospitals presented a problem of interest to engineers. We had no precedent to work to, and due to nearness to the shore and the high ground water level during the rainy season, the lower portion had to be watertight. This was dictated by two additional reasons—the nearer ground level the completed building could be erected, the more natural would be

(*Continued on page* 20)

Sand in Adolf's eye...

THIS man is a glass chemist. And the sand he's working with is going to get into Adolf Hitler's eyes and hurt.

Here's how. Glass, basically is made from sand. And glass in this war, in the skilled hands of American glass makers, is a potent weapon. It replaces metals on many jobs, metals needed for killing Huns and Japs.

In bombsights and fire control instruments glass helps to rain accurate death on the enemy. In heavy industries, such as the explosive industry, its characteristic resistance to corrosion speeds powder output. Glass in medical and laboratory fields puts us and our allies ahead in hospital treatment and in vital laboratory developments.

The U.S. is lucky in having a well established glass industry and not having to lean upon any part of the outside world for this essential material. Glass was ready for war, and was able to contribute to the speed records set by other industries such as gasoline and synthetic rubber.

It took a lot of research to make American glass the best in the world. At Corning way back in peacetime, more than 200 laboratory men were working steadily on new forms of glass and new uses for this amazing material. More than 25,000 formulae for glass were developed. Today around 250 different types of glass are in production under the "E" pennant at Corning's main plant.

There are glasses for example that withstand corrosive chemicals, that cannot be harmed by heat, that have high electrical insulating qualities, that are extremely resistant to mechanical breakage. And these are only a few of the reasons that engineers, too, consider glass the material with endless possibilities for the future. Corning Glass Works, Corning, New York.

CORNING
means
Research in Glass

Destination—"Island X"

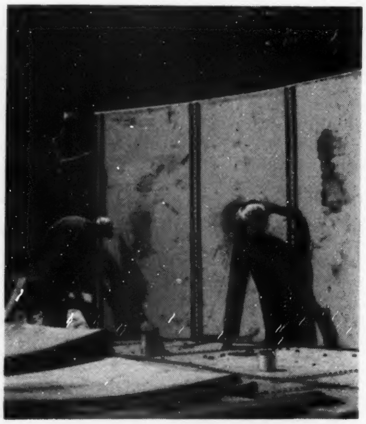
(*Continued from page* 18)

its appearance and the less obvious to air reconnaissance. Secondly and most important was the unavailability of fill for partially "bomb proofing" the completed structure.

Blackout Problems

Every type of structure at an advanced base has one important feature that does not occur in everyday construction problems on the mainland. That is the question of the blackout, which is hardest to solve in above ground level structures that are used during the night hours. These include barracks, recreation quarters, mess-halls and heads. The ventilation of buildings was accomplished by slatted louvres pointed downward and painted black. Windows had plywood shutters which were painted black on the inner reflecting surfaces. The entrances were protected against light leakage by means of black-out shields on the style of a maze or a labyrinth which were painted black on the inside and coral color on the exterior.

When most of the pressing construction had been gotten out of the way, we were able to get the men out from underground and start the building of barracks. These were approximately 35 feet by 75 feet in size, elevated about 2 feet above the ground and about



Official U. S. Navy Photograph
Seabees assemble a 10,000 gallon water tank

10 feet high at the eaves and 12 feet high at the peak. Each unit housed about fifty men, using double-decker bunks. There was a room for the Master-at-Arms of each barracks and his relief or assistant appointed by the occupants, and subject to the approval of the Officer-in-Charge. Each barracks building was constructed within a reasonable distance of head facilities.

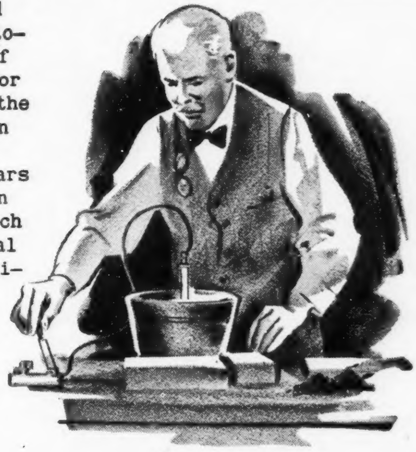
A Soil Mechanics Problem

One other type of structure that cannot be divulged due to its nature, involved a problem of soil mechanics. The unit required great rigidity and we sought to accomplish this by driving a square of four steel H beams about 30 feet long into the coral to a depth of 20 feet and about 20 feet apart. These were inter-laced with a steel deck frame about 6 feet above ground and a heavy timber deck and enclosure. On the first test the entire assembly moved out of line as a unit. The coral was so coarse that it reacted to shocks or impact in the manner of a heavy liquid. This was corrected to a great extent by removing the first two feet of coral at ground level and welding steel cross members and laying a reinforced concrete lower deck 24 inches thick to give added mass and dead weight necessary to achieve the de-

(Continued on page 22)

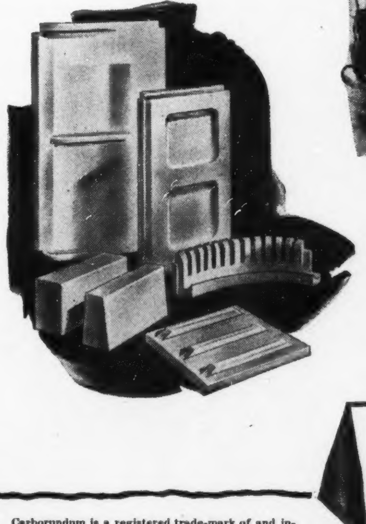
Looking at the future through a little iron bowl!

1) This little iron bowl helped shape the pattern of industry today; it holds the key to much of the progress that is to come. For in it Dr. E. G. Acheson created the first man-made abrasive, silicon carbide, to which he gave the trade name "Carborundum"—52 years ago. From that discovery in turn came the super refractories which opened the way for the economical development of modern metallurgical processes.



2) For instance, one of these super refractories is vitally important to the process by which our huge naval and coast defense guns are annealed under closely controlled conditions.

3) To withstand other specific service needs covering a wide range of conditions over 65 varieties of Carborundum Brand Specialized Refractories are available. Used in furnaces, kilns, retorts and refining equipment, they are helping to speed output of thousands of war essentials.



4) After the war, these super refractories will help produce new and better materials. When you encounter a refractory problem in the field, remember Carborundum Refractory Specialists stand ready to help you solve it. The Carborundum Company, Perth Amboy, New Jersey.

REFRACTORY
CARBORUNDUM
PRODUCTS

Destination—"Island X"

(*Continued from page* 20)

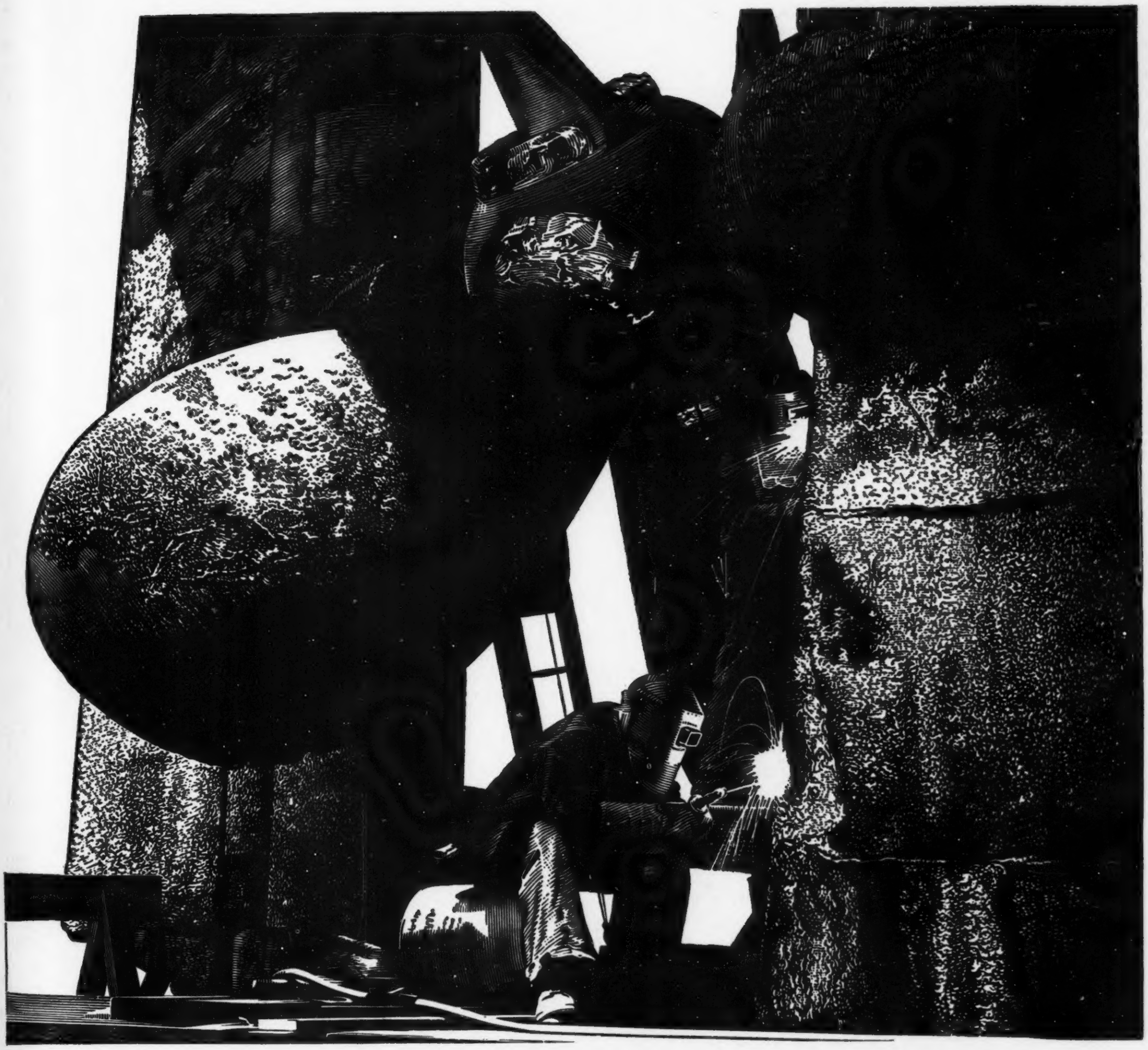
sired result.

Work hours were from 0600 to 1630 with one hour out for lunch, since many men had to walk a considerable distance to chow. Some of the activities required 16, 20 or 24 hour shifts and every one was most happy to do his part. The men worked 6½ days a week when we first landed. After several months the half-day Sunday was cut out and the men drilled for two hours Sunday morning and then attended Church or went back to their sacks. Attendance at Sunday breakfast on the few occasions when night drill in tactics superseded Sunday morning drill was 50% of normal. On one occasion the entire outfit worked through a 36 hour period painting and gassing planes prior to their going out on a distant mission to leave calling cards. The nearest liberty port being considerably more than a thousand miles distant, there was no grumbling about liberty. During the rainy season when dugouts were used, the daily sick list was about 4% of our personnel. When the men were housed above ground, it dropped to less than 2%. The chow was good and plentiful, but when periods of course, when supply supply ships were late, we had extended periods when there was no bacon, beef, or whole eggs. Canned pork and powdered eggs is not a most delectable diet, but they keep the body going. Fresh vegetables came in occasionally and what a treat—salads twice daily until the greens were completely exhausted. The lack of milk was what we noticed most, although it is alleged that a "mechanical cow" can give a reasonable imitation thereof.

Morale

The morale of the men was excellent. The climate was pleasant and healthful and they were all well trained and happy. Swimming and fishing were the main recreational facilities. The men could fish either from the dock, the beach, or from the dories or skiffs available. The fishing was excellent and red snapper, tuna, alua, albacore and coral fish abounded. The search for "cats-eyes", a semi-precious stone obtained from a mollusk, went on continually. The men were permitted to take patrol hops with the P.B.Y. Catalinas, when there was room available. One was a 14 hour hop, the other only 3 hours. Officers and gunner's-mates had the additional opportunity of going up occasionally in the rear seat of the S.B.D.-3, one famous Navy Dive Bomber—an unforgettable thrill, especially during the levelling off moments. The Seabees brought ice cream mixers with their galley equipment and every man on the island had this delicacy at least once weekly. We built a recreation hall and theatre, complete with cobbler, tailor and barber shops, and Post Office. The Ship's Service was well stocked. Candy was usually disposed of in box lots within three days of receipt—but there was always a sufficiency of cigarettes at five cents a pack. With so little opportunity for spending money, the men had accumulated good sized balances on the books, and it was not unusual to see men spend $100 to $200 for ladies watches and rings to send back home. The purchases of War Bonds were also phenomenal. The

(*Continued on page* 24)



Destination—"Island X"

(*Continued from page* 22)

men got along wonderfully well with the other services aboard our base. A factor that was of especial benefit to the officers and chiefs in the control of the men was the presence of a good proportion of older men. They served as an important stabilizing influence in handling the younger of the crew. Many had boys of corresponding ages at home and acted just as fathers would have.

The cooperation between Seabees and Navy Ship's Company, Marines and Army was astounding. One of the highest tribute I heard to my men was given by a Marine Artillery Officer who furnished a working party for some small goods unloading. He inquired of the Sergeant in Charge of the detail as to their accomplishments. The Sergeant reported "Sir, we worked very hard, the Navy gave some help and so did the Army! but those Seabees, sir, they just worked like hell."

And daily reports indicate that the Seabees are still working like hell and DOING.

Testing Foundry Sand

(*Continued from page* 9)

time. A soaking time of 12 minutes is recommended when one wishes to determine the actual hot strength of the sand at the chosen test temperature. Shorter soaking times of 1, 2, 4, 6, and 8 minutes are also of practical value.

Data Recorded

The maximum pressure reading causing the sand specimen to crush is recorded as pounds per square inch hot strength. In recording the data, the following method is recommended. First the hot strength is recorded, then the furnace temperature and the soaking time, and last, the letter G, D, or B to indicate respectively whether the sand specimen was green, dry, or baked. A hyphen is placed in between each designation, as in this example:

21 - 2500 - 12 - G

Then the furnace is raised and the broken specimen is removed. The furnace is immediately lowered and the pyrometer controller is set at preheat temperature. When the furnace has reached the preheat temperature, a new sand specimen is rammed for the next test. The sand specimen must not be allowed to air dry for a green sand specimen test. For baked or dried specimens, only specimens that are cooled to room temperature and stored in a moisture free desiccator should be used.

The Sub-committee directing the elevated temperature studies decided as part of its program to conduct a co-operative investigation. This is carried out with the Foundry at the Naval Research Laboratory under the direction of Mr. H. F. Taylor. The two laboratories were directed to find whether or not two laboratories, using the same testing equipment, could duplicate hot compressive strength tests. To date, the two laboratories have been able to duplicate each other under certain limited conditions of specimen exposure time to shock heating and temperature control settings. The tests so far show that some types of sand mixes lend themselves to better duplication than others. The results of the cooperative tests will be published in the forthcoming 1944 edition of the "Transactions of the American Foundrymen's Association."

Publications

(*Continued from page* 16)

devoted to smelting and the last six to metalworking and founding. Since the author was primarily a metalworker, he depended on information from others for his description of smelting methods. He has very little to say on mining methods and in this respect does not encroach upon the chief field of Agricola's "De re Metallica." In the "books" on metalworking, he goes into detail concerning the working of ferrous and nonferrous metals and into the casting of statues, bells, and cannon.

When one recalls the extent to which alchemy was hopefully believed in during Biringuccio's time, one is struck with the directness and realism of his writing. His approach to alchemy may be summed up by his statement, "many are quoted by the credulous, who advance the authority of hearsay in place of reasons for possible success or facts that can be demonstrated." His attitude toward the alchemists, however, was tolerant for he says, "I know that, if perchance some who are passionately devoted to this art should read my work, they would denounce me, accusing me of ignorance and presumption—and if I should hear them, I would patiently agree so as not to quarrel with them."

He recognizes gold as the most desirable of all metals. The more it is fired and worked, he says, the purer it becomes. "Nature with her own virtue has endowed gold, as a singular privilege, with power to comfort weakness of the heart and to introduce there joy and happiness disposing the heart to magnanimity and the generosity of works. Many learned men say that this power has been conceded to it by the benign influence of the sun and that for this reason it gives so much pleasure and benefit with its great powers—particularly to those who have great sacks and chests full of it."

The author discusses at some length the construction of furnaces for handling a variety of metals. His illustrations are clear and concise and together with the text give very clearly the methods employed in those days.

One very interesting section of the book is devoted to boring cannon. He shows drawings of several types of cutting heads on the boring bars and the manner in which the gun barrel was mounted on a movable carriage while the rotating boring bar was held at a fixed location.

The author discusses at length the preparation of sands and powders for casting. One chapter is devoted to the preparation of greensand molds. Another chapter is devoted to advice "On How to Operate a Mint Honestly and With Profit."

Since it is necessary to make brick and crucibles for melting purposes, the author includes procedure for making lime and bricks and pottery and how to fire them. He also describes methods of making saltpeter and gunpowder and how they may be used to make fireworks and incendiary arrows and grenades.

The translation is a scholarly piece of work. Important but doubtful passages are annotated. Notes on contemporary references have been added to broaden the knowl-

(*Continued on page* 28)

Publications

(Continued from page 26)

edge of the horizon of the author's time.

One cannot escape the atmosphere given to this work through the choice of typography, paper, and binding and through the reproduction of the woodcuts of the original volume. It reflects the care with which the translators and the publishers have joined to present this important work with thoroughness and accuracy. Moreover, it carries into a modern publication some of the art and charm of the earlier books.

S. C. Hollister
Dean of the College of Engineering

(Reprinted from the April, 1943, issue of "Mechanical Engineering" with the permission of the reviewer and the publishers.)

Magic With Mathematics

(Continued from page 11)

$\frac{1}{2}(1) + \frac{1}{4}(2) + \frac{1}{8}(4) + \ldots$ extended to every possible value of n. But this series simplifies into

$$\tfrac{1}{2} + \tfrac{1}{2} + \tfrac{1}{2} + \tfrac{1}{2} + \ldots$$

which, since there is no limit to n, is an infinitely increasing series! In other words, in order to play this game fairly to the bank the player must first pay the bank an infinite amount of money. No matter how much money the player stakes on the game, he will win, in the end! Said Thornton C. Fry, mathematician with Bell Telephone Laboratories, in commenting on this solution: "From a common sense standpoint this result is absurd. No sane man would ever consider paying the bank one hundred dollars for such a chance, much less an infinite amount. And yet the mathematics itself is straightforward."[5]

Conclusion

While the St. Petersburg Paradox makes the more bewildered doubt the veracity of mathematics, there is much in mathematics which is undoubtedly true and is at the same time mysterious and beautiful. It is with an example of the beauty attainable in mathematics that we would like to conclude this article. It is a formula which again includes the previously-met, versatile number, pi, and also its most famous fellow-transcendental, e, and the imaginary, i. The formula is

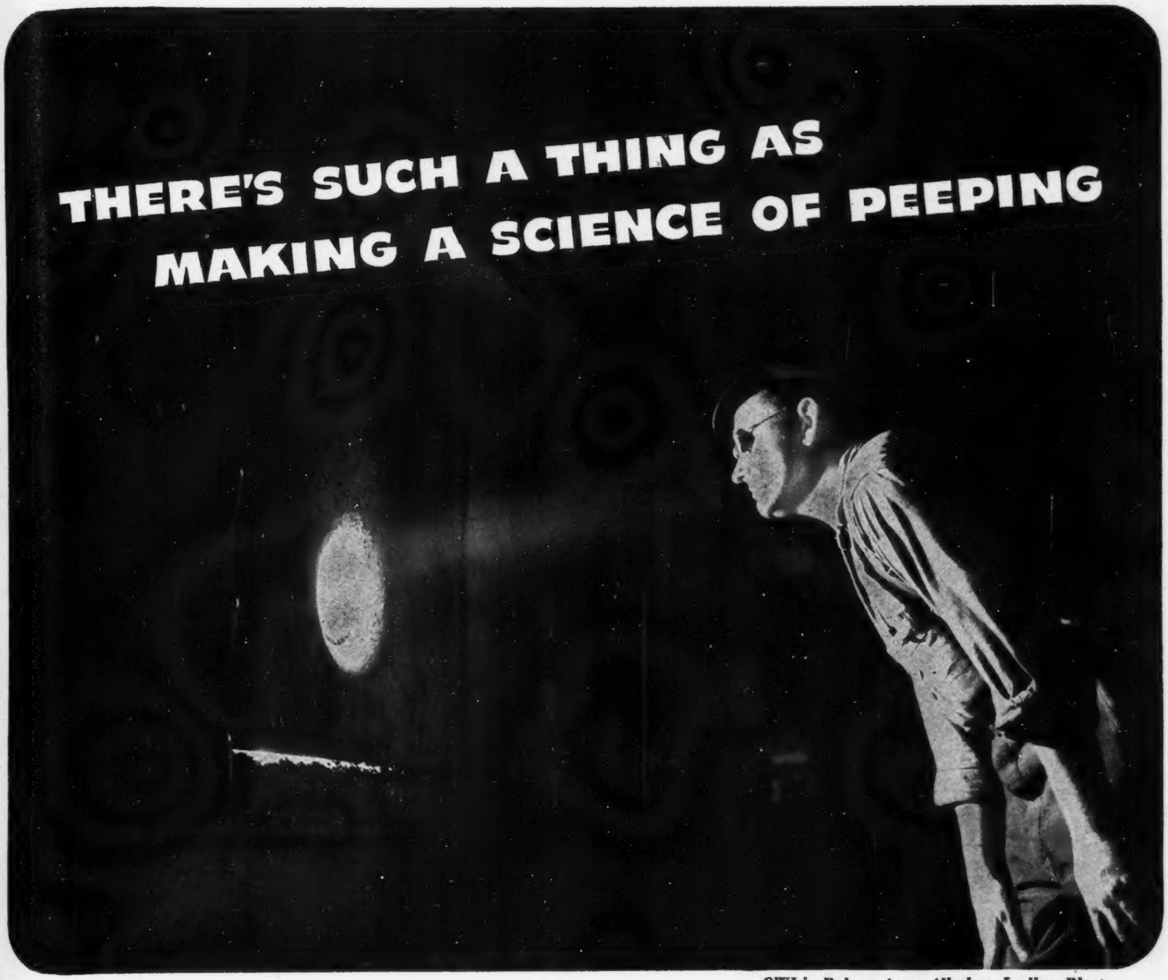
$$e^{i \times pi} = -1$$

In telling his mathematics classes at Harvard of this formula Benjamin Pierce said:

"This is surely true. It is absolutely paradoxical. We cannot understand it and we don't know what it means but we have proved it, and therefore we know it must be the truth."[6]

FOOTNOTES

1. Simon Newcomb, American astronomer and mathematician, made this remark about pi.
2. Proofs of these theorems may be found in "Mathematics For the Millions" by Lancelot Hogben. (Norton and Company, 1937).
3. There is a complete discussion of this problem in "An Introduction to Mathematical Probability" by J. V. Uspensky. (McGraw-Hill, 1937).
4. A very complete discussion of magic squares and methods of making them may be found in "Magic Squares and Cubes" by W. S. Andrews (Open Court, 1917).
5. The St. Petersburg Paradox is completely discussed in "Probability and its Engineering Uses" by Thoornton G. Fry (Van Nostrand, 1928). "Mathematical Recreations" by Kraitchik (Norton, 1942).
6. The quotation is taken from "Mathematics and the Imagination" by Kasner and Newman. (Simon and Schuster, 1940).



OWI by Palmer, in an Allegheny Ludlum Plant.

WITH this melter, studying the action of some 35 tons of alloy steel in an Allegheny Ludlum electric furnace, peeping is resolved into a science.

His job is one of the earliest in a long series of operations which bring a melt of Allegheny Ludlum stainless, electrical or other alloy steel to its final form, rigidly true to specifications. His experience determines whether the molten mass within the furnace is progressing at the proper rate, and dictates any adjustments necessary to produce the quality of steel specified.

His judgment is double checked, of course, by thousands of dollars worth of amazingly accurate testing equipment, built for analyzing with hairline precision.

For, in wartime especially, the properties of alloy steels must be maintained with the utmost consistency. Lives of men—even the outcome of battles depends upon this uniformity, because the place of alloy steels is always in the vital heart of a war mechanism.

Lives and battles depend upon other things in this war, too—matters that come home to every household. Buying bonds, conserving food, fuel, gasoline, rubber, waste fats and scrap metal—all these have to do with how soon the war will be won, and at what price. They are *everyone's* jobs. Have you done—are you doing—*all* you can?

Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

A-8841 . . . W & D

Production Award

(*Continued from page* 12)

Ithacan, the former Martha Gertrude Bovier. A son, George, received the degree of bachelor of science in administrative engineering in May, 1943, from Cornell.

E. C. Crittenden

EUGENE C. Crittenden, '05, was elected vice-chairman of the Standards Council of the American Standard Association at a recent election meeting.

Mr. Crittenden is also assistant director of the National Bureau of Standards and chief of the Electrical Section. He has been president of the United States National Committee of the International Electrotechnic Committee since 1939. He has been with the National Bureau of Standards since 1909 and a member of the ASA Standards Council since 1925.

N. C. Farr

RECENTLY named chairman of the Illinois U.S.O. committee was Newton C. Farr, CE '09. Mr. Farr has been quite active in U.S.O. work, having been a member of the U.S.O. executive committee last year and also vice president of the U.S.O. council in Chicago. Mr. Farr is the senior partner of Farr & Co. and the chairman of the Alumni Association Committee on Alumni Trustee Nominations.

Citation For Gallantry

(*Continued from page* 13)

nis is a member.

The commendation read in part: "The Chief of Naval Personnel takes pleasure in commending you for the conspicuous bravery and devotion to duty which you displayed as a member of the Armed Guard Unit aboard a merchantman during action against enemy aircraft in the Mediterranean area on July 6, 1943.

"A report of experiences reveals that your ship and the areas about her were subjected to a vicious attack by approximately 20 hostile planes. In spite of constant danger from falling bombs and shrapnel, the Navy gun crew valiantly manned their battle stations and threw up such an accurate barrage of blazing shellfire that the enemy was driven off with the loss of five planes, some of which were undoubtedly sent to their destruction by your guns. Your prompt and effective action prevented the sinking of your ship and contributed greatly to the successful completion of the convoy's mission."

"Your courageous fighting spirit and the excellence of your performance on this occasion were in keeping with the best traditions of the U. S. Naval Service."

ASCE

A technicolor sound movie, "Reinforced Concrete Construction and Movable Forms", was shown at a meeting of the A.S.C.E. held in Sibley on Thursday, January 27. The picture, explained by Pfc. Troast, R.O.T.C., illustrated the details of construction operations on a reinforced concrete building being erected by his father's company.

In the future, the A.S.C.E. plans to hold monthly meetings with outside speakers as guests.

"Sacrificial Corrosion"

. . . . do you know what it means?

The zinc coating on galvanized sheets or other products protects the iron or steel underneath in two ways: 1, by simple coverage, with a sheath of rust-resistant metal; 2, by electrochemical action or "sacrificial corrosion". The first is clearly understandable, but the second is more complex.

When two metals are put into an acid solution or electrolyte, each will tend to oxidize and to cause an electric current to flow toward the other. The metal more chemically active will oxidize more rapidly and produce the stronger current, and will keep the other metal from oxidizing. This is known as "sacrificial corrosion".

Remember the old "door-bell battery", with the zinc and copper elements? How the zinc gradually oxidized, or corroded away, while the copper was practically unaffected? Here the zinc saved the copper by sacrificial corrosion.

Through an electrochemical action similar to this the zinc on galvanized sheets gives the second kind of protection to the iron or steel base metal: the moisture in the air acts as the electrolyte in microscopic electric cells formed by the zinc and any exposed base metal, and then by "sacrificial corrosion" the zinc keeps the iron or steel from rusting.

ZINC is "by far the Best" Protective Metallic Coating for the Rust-Proofing of Iron and Steel

All sorts of buildings for the storage and processing of food are covered, roof and sides, with galvanized sheets. Certain steps can be taken which will make this material render better service and last almost indefinitely. These are described in the booklet "How to Make Galvanized Roofing Last Longer", which the Zinc Institute has prepared as part of its contribution to the "Food Fights for Freedom" campaign. It is a booklet worth having. Write for it—it's free.

American Zinc Institute
INCORPORATED
60 East 42nd Street, New York 17, N.Y.

STRESS and STRAIN...

WCTU Lecturer: "Here's an argument from nature. If I lead a donkey to a pail of water and to a pail of beer, which will he drink?"
Cornellian: "The water."
Lecturer: "Right. Why?"
Cornellian: "Because he's an ass."

* * *

"Don't you think George dresses nattily?"
"Natalie who?"

* * *

"Say, Doc, what's wrong with me?"
"There's nothing wrong with you; you're just lazy."
"I know that, but give me the long scientific name for it so I can impress my PT instructor."

* * *

When a fellow breaks a date,
He usually has to.
When a coed breaks a date,
She usually has two.

* * *

Prof.: "This exam will be given on the honor system. Please sit three seats apart and in alternate rows. An instructor will be placed between every two students."

Bashful lover: "If I threw a kiss across the room would you consider me bold?"
Bored young blonde: "No, just lazy."

* * *

"I shall now illustrate what I have in mind," said the professor as he erased the board.

* * *

"I see you're getting quite chummy with your profs."
"Yep, familiarity sometimes breeds exempts."

* * *

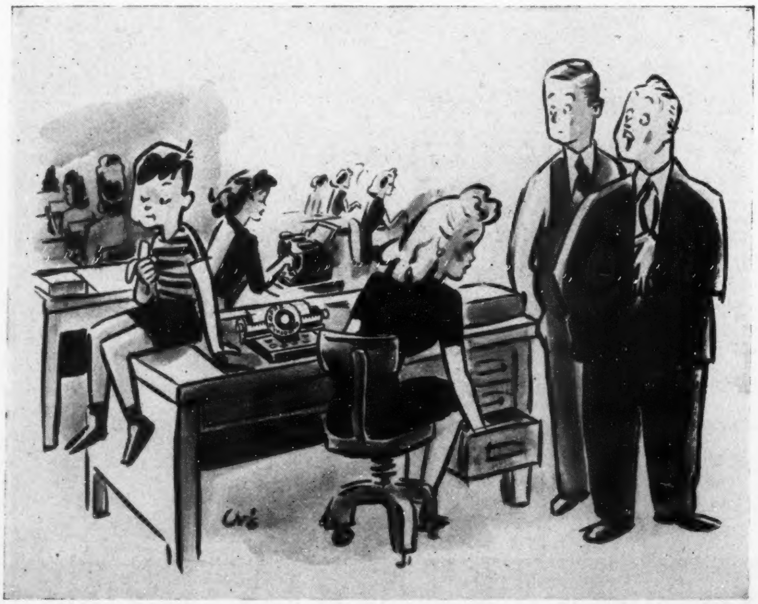
"I see by the paper that nine professors and one student were killed in the wreck."
"Poor chap."

* * *

"Tell me the story of the police raiding your fraternity."
"Oh, that's a closed chapter now."

* * *

And then there's the ME who has designed a machine that will do half a student's homework for him. He intends to sell two of them to every entering freshman.



Courtesy Westinghouse

"We just have to have another typewriter, but the kid won't let it out of his sight."

Professor: "What kept you out of class yesterday, acute indigestion?"
Co-ed: "No, a cute engineer."

* * *

If every boy in the United States could read every girl's mind, the gasoline consumption would drop off fifty per cent.

* * *

Soph: "But I don't think I deserve an absolute zero."
Prof.: "Neither do I, but it is the lowest mark I am allowed to give."

* * *

"Was it very crowded at Zinck's last night?"
"Not under my table."

* * *

"Did you pass the refrigeration exam?"
"Sure. I knew it cold."

* * *

Professor: "I will not begin today's lecture until the room settles down."
Voice in the rear: "Go home and sleep it off old man."

* * *

"It's a pleasure to lend you this five."
"Then why not really enjoy yourself and give me ten?"

* * *

Anthropology Prof. (lecturing): "—and the women of the tribe wear nothing . . ."
Student (waking suddenly): "Where is that place, professor?" And upon the reply he took the first lecture note in four years.

* * *

Another ChemE has developed a process to utilize excess donut holes to stuff macaroni.